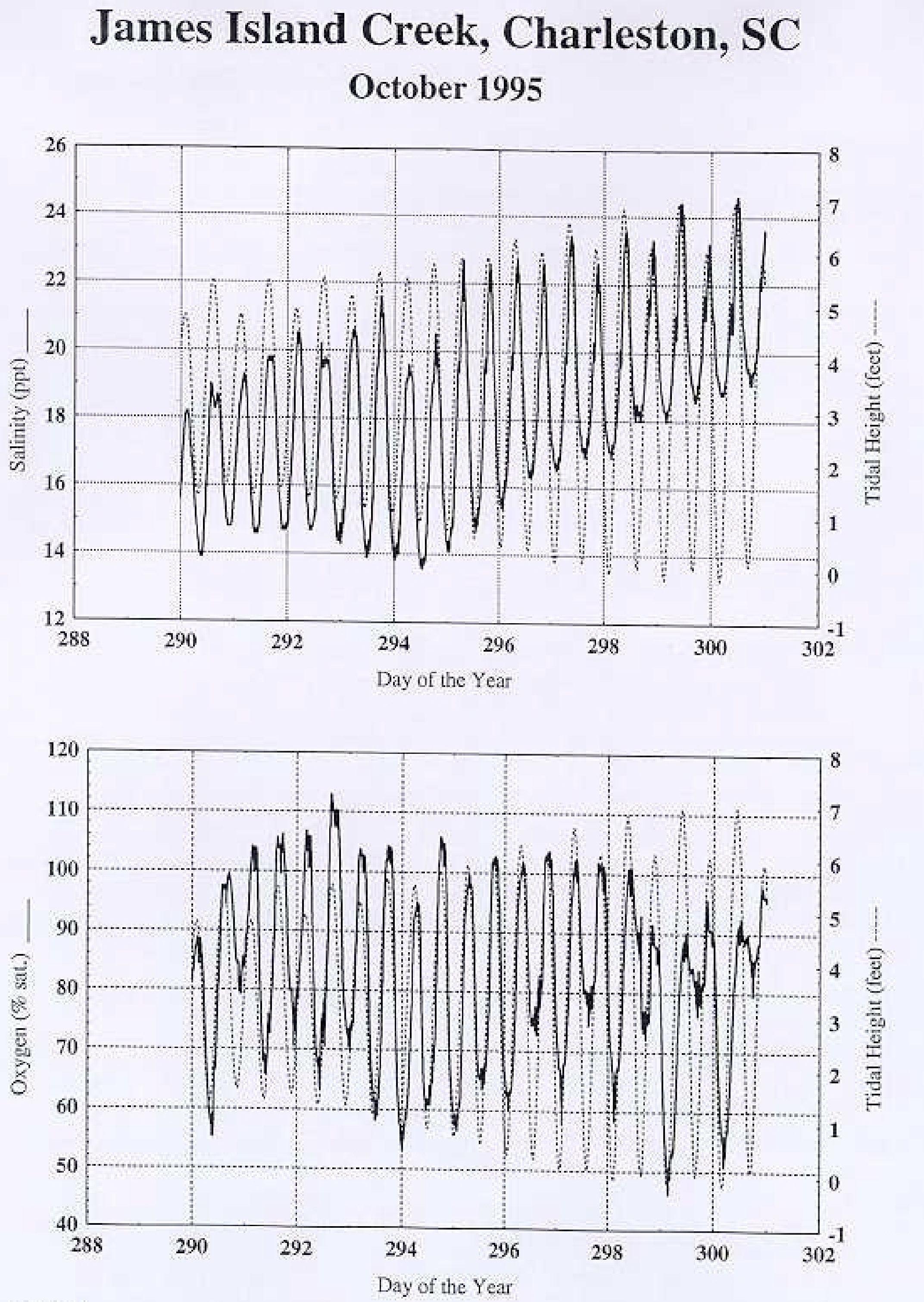
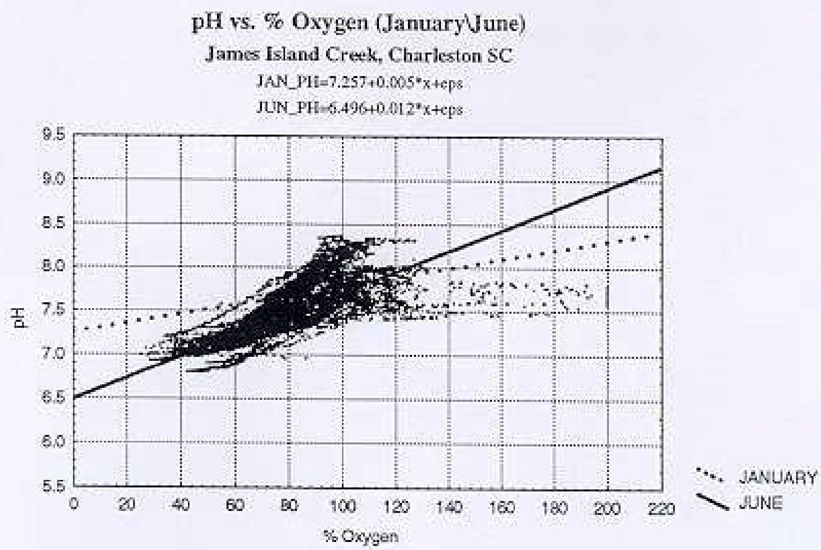


Figure 7.

Virtually all the recording show a strong positive correlation between pH and dissolved oxygen which strongly suggests that a large fraction of changes in pH are due to water column respiration (L. Burnett. per. comm.). The slope of the relationship changes seasonally and is different between creeks (Fig. 8). The pH values at the origin of each x-y plot (at zero percent oxygen) show opposite seasonal trends for the two locations. James Island Creek has lower pH value at zero oxygen in the summer months while the pH at Toomer Creek is lower at the origin in winter.



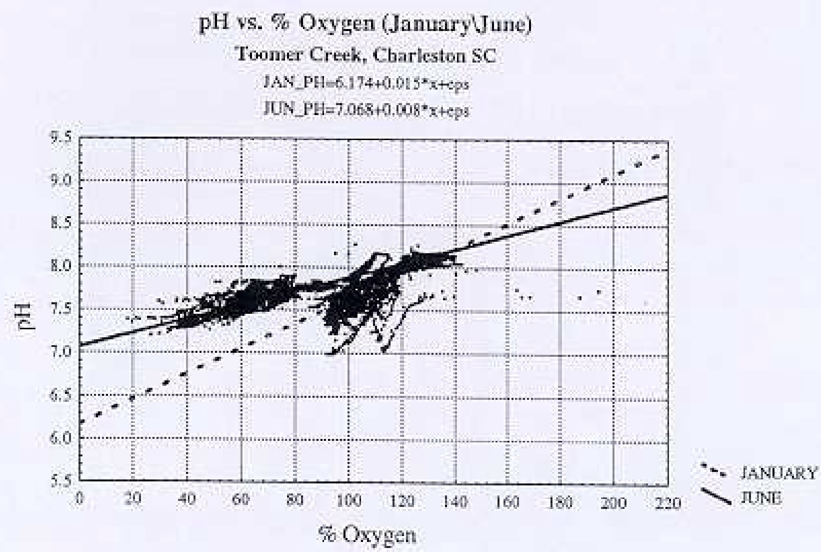


Figure 8.

Respiratory processes and dissolved organic acids (humic substances) both make significant contributions to the pH of an estuarine creek. The differences between James Island and Toomer Creeks lead one to question the relative roles of respiratory and dissolved organic acids in these two basins. Respiratory loading may be higher in James Island Creek which would explain why the lowest pH readings occur in the summer months when respiration is at its highest. Toomer Creek, more of a black water creek, exhibits lowest pH values in the winter, when rainfall leaching through the watershed may be a more active process. The watershed of James Island Creek is well tended with much of the yard waste, lawn clipping and tree leaves, being carted out of the system. The loss of natural vegetation combined with increased input from urban agricultural waste (lawn clippings, disturbed soils, etc.) and the loss of the forest root mat infrastructure to trap and/or absorb runoff, might result in higher summer respiratory rates (from the addition of substrate) and reduced addition of naturally acidic leachate (decreased input of acidic materials). On the other hand, Toomer Creek, with less developed lands, would have a greater proportion of land covered with forest leaf litter from the mixed pine and hardwood vegetation. Leaching from such detrital material is relatively rich in humic acids which might tend to lower the pH of the surrounding waters. Particulates are more likely to be trapped in the soils as the ground water percolation appears to be greater that surface runoff in forested vs urbanized systems, which might reduce the respiratory loading input into Toomer Creek.

Storm Event.

A severe winter storm in March of 1993 was simultaneously recorded in both creeks (Fig. 9 and 10). A creek to creek comparison of the records reveals that salinity dropped faster and lower in James Island Creek. The regular tidal periodicity was maintained in both creeks however, the signal in James Island Creek seemingly became more chaotic or noisy during and after the storm. The pH appeared to have more high frequency noise in James Island Creek but dropped lower in Toomer, possibly due to the influx of dissolved organic acids from decaying vegetation. Oxygen levels dropped at both sites with a greater loss at James Island Creek.

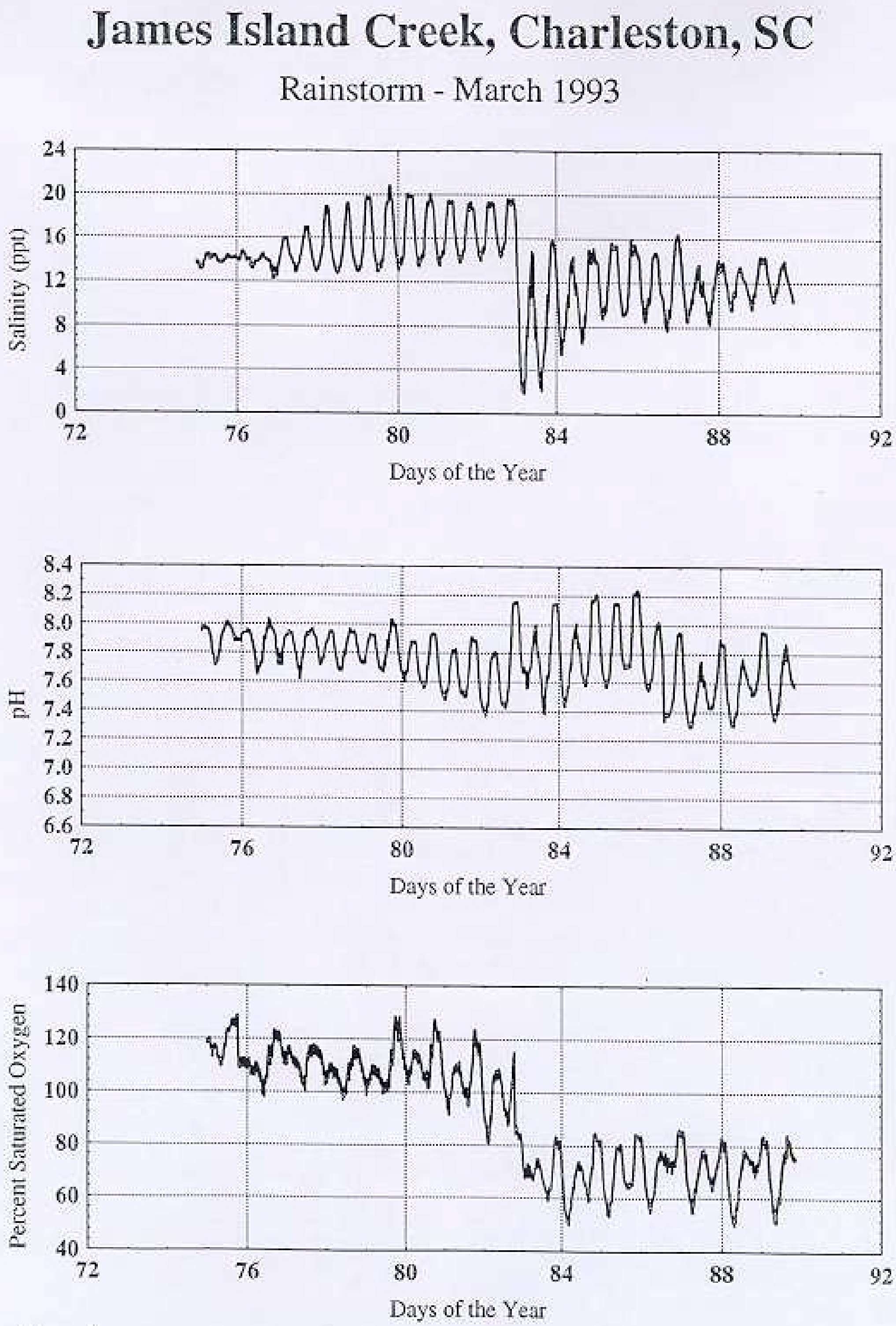

James Island Creek, Charleston, SC
Rainstorm - March 1993
Salinity (ppt)
24
20
16
12
8
4
0
72
76
80
84
88
92
Days of the Year
pH
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
72
76
80
84
88
92
Days of the Year
Percent Saturated Oxygen
140
120
100
80
60
40
72
76
80
84
88
92
Days of the Year

Figure 9.

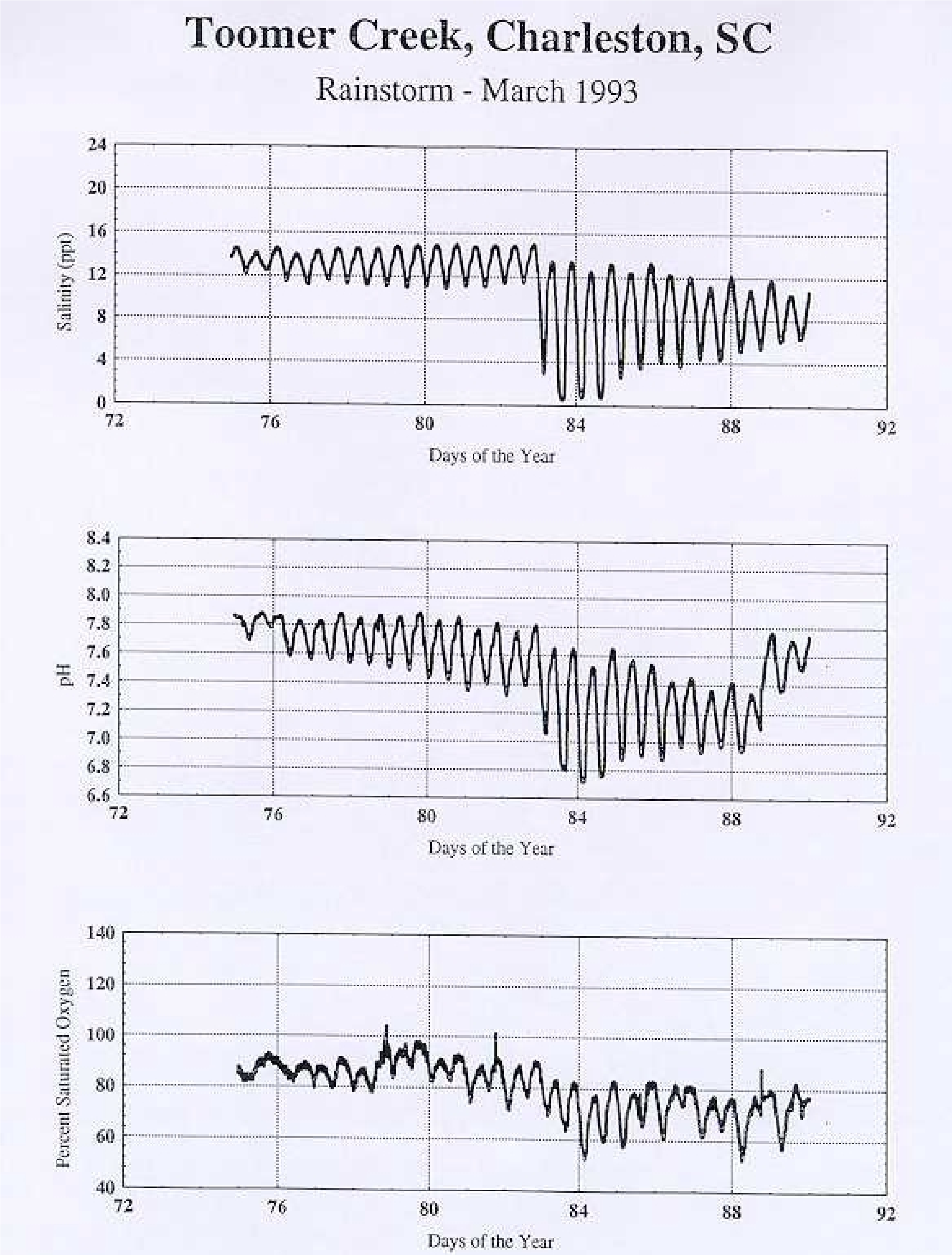


Figure 10.

The dynamics of the storm are more easily visualized using spectral analysis (Fig. 11 to 16). This analysis shows that each site displays a strong periodicity at 12 an 24 hours (possibly tidal and solar cycles). However, the ratio of the 12 to 24 hour peaks change post-rain at James Island Creek (approx. 3/4 to 1/3) and remains relatively constant at Toomer Creek (approx. 1/2). Examination of the power spectrum at wavelengths below 12 hours reveals that Toomer Creek displayed a stronger spectral density (sharper signal) at 6 hours in salinity, pH, and oxygen.

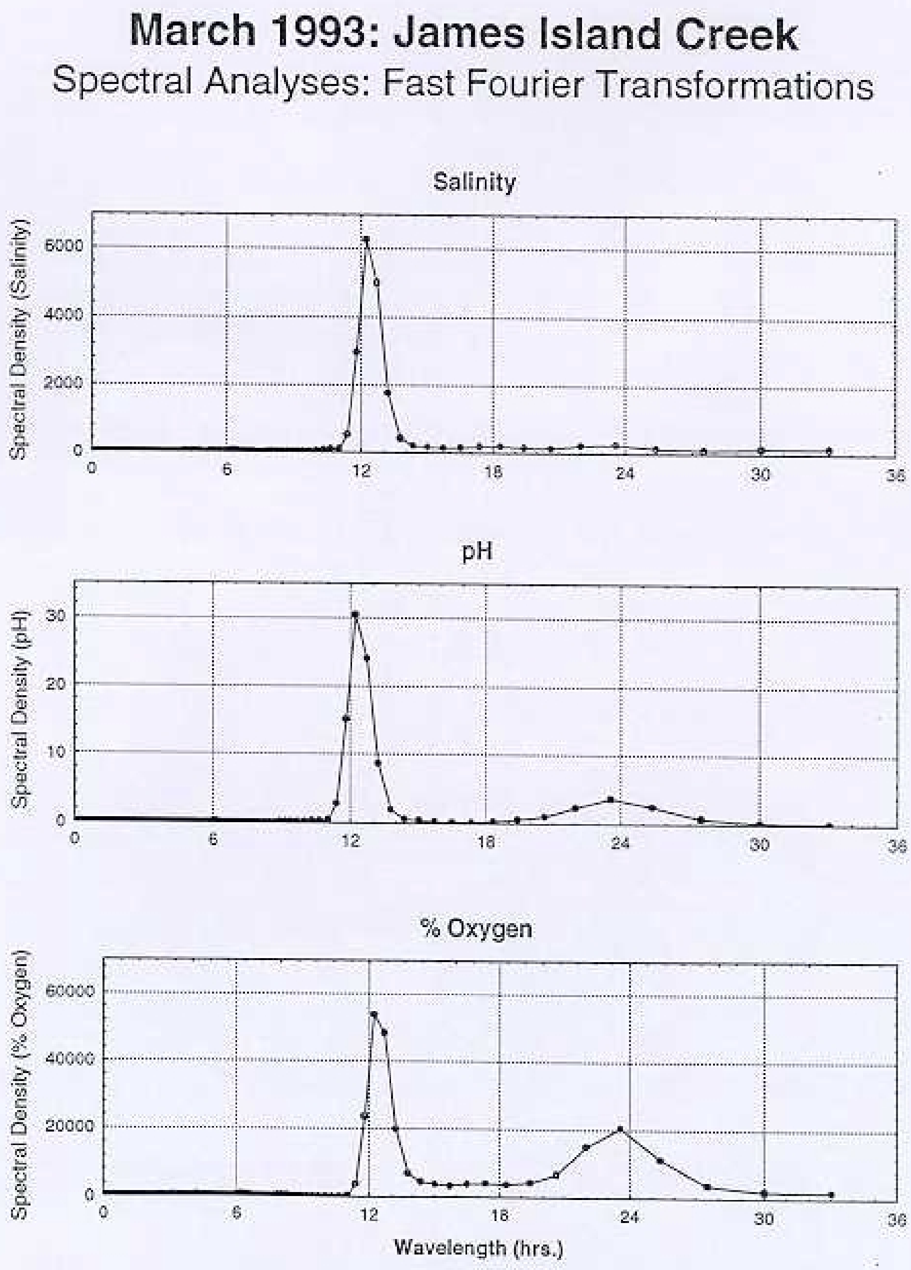

March 1993: James Island Creek
Spectral Analyses: Fast Fourier Transformations
Salinity
Spectral Density (Salinity)
6000
4000
2000
0
0
6
12
18
24
30
36
pH
Spectral Density (pH)
30
20
10
0
% Oxygen
Spectral Density (% Oxygen)
60000
40000
20000
Wavelength (hrs.)

Figure 11.

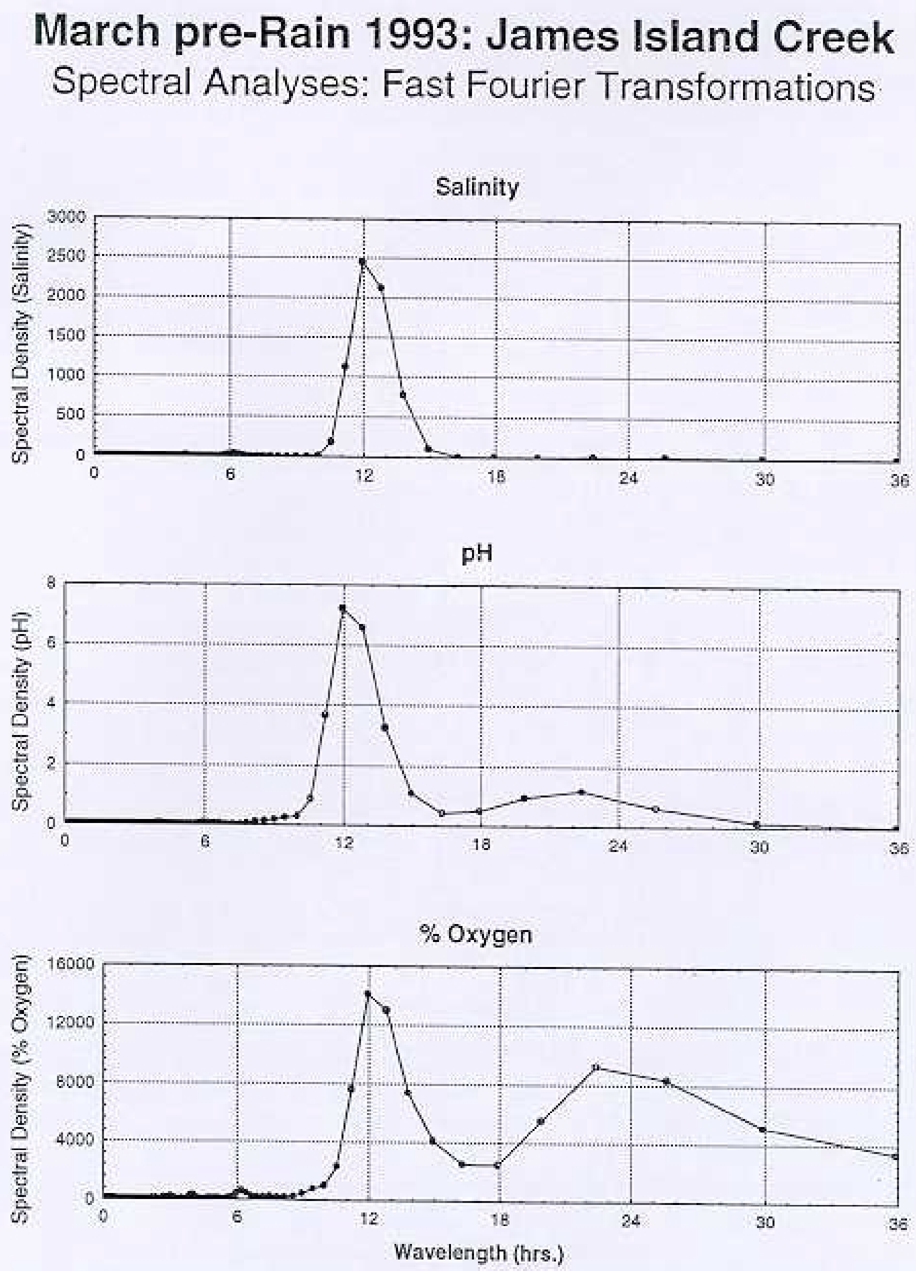

March pre-Rain 1993: James Island Creek
Spectral Analyses: Fast Fourier Transformations
Salinity
Spectral Density (Salinity)
3000
2500
2000
1500
1000
500
0
0
6
12
18
24
30
36
pH
Spectral Density (pH)
8
6
4
2
0
% Oxygen
Spectral Density (% Oxygen)
16000
12000
8000
4000
0
Wavelength (hrs.)

Figure 12.

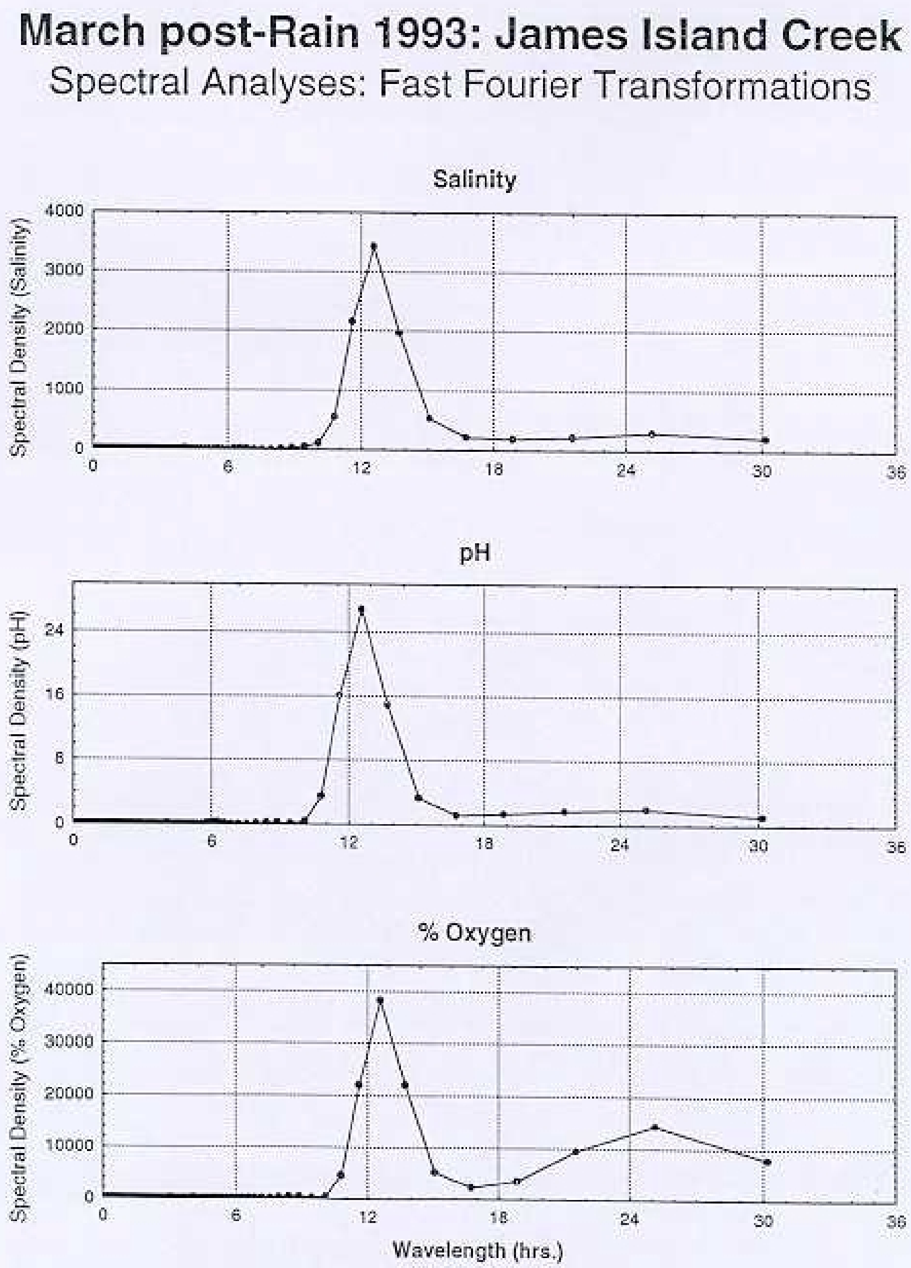

March post-Rain 1993: James Island Creek
Spectral Analyses: Fast Fourier Transformations
Salinity
Spectral Density (Salinity)
4000
3000
2000
1000
0
0
6
12
18
24
30
36
pH
Spectral Density (pH)
24
16
8
0
0
6
12
18
24
30
36
% Oxygen
Spectral Density (% Oxygen)
40000
30000
20000
10000
0
0
6
12
18
24
30
36
Wavelength (hrs.)

Figure 13.

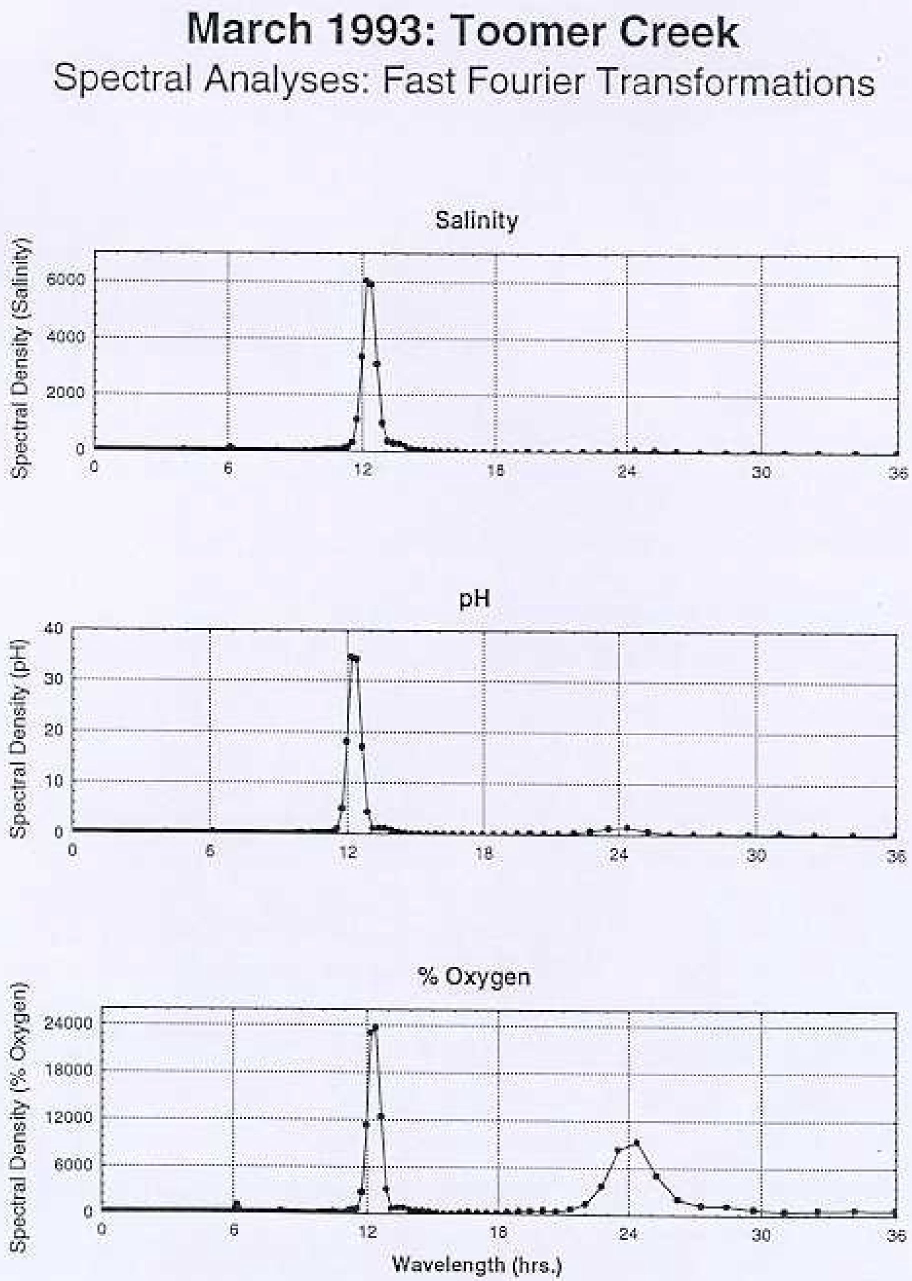

March 1993: Toomer Creek
Spectral Analyses: Fast Fourier Transformations
Salinity
Spectral Density (Salinity)
6000
4000
2000
0
0
6
12
18
24
30
36
pH
Spectral Density (pH)
40
30
20
10
0
0
6
12
18
24
30
36
% Oxygen
Spectral Density (% Oxygen)
24000
18000
12000
6000
0
0
6
12
18
24
30
36
Wavelength (hrs.)

Figure 14.

March pre-Rain 1993: Toomer Creek

Spectral Analyses: Fast Fourier Transformations

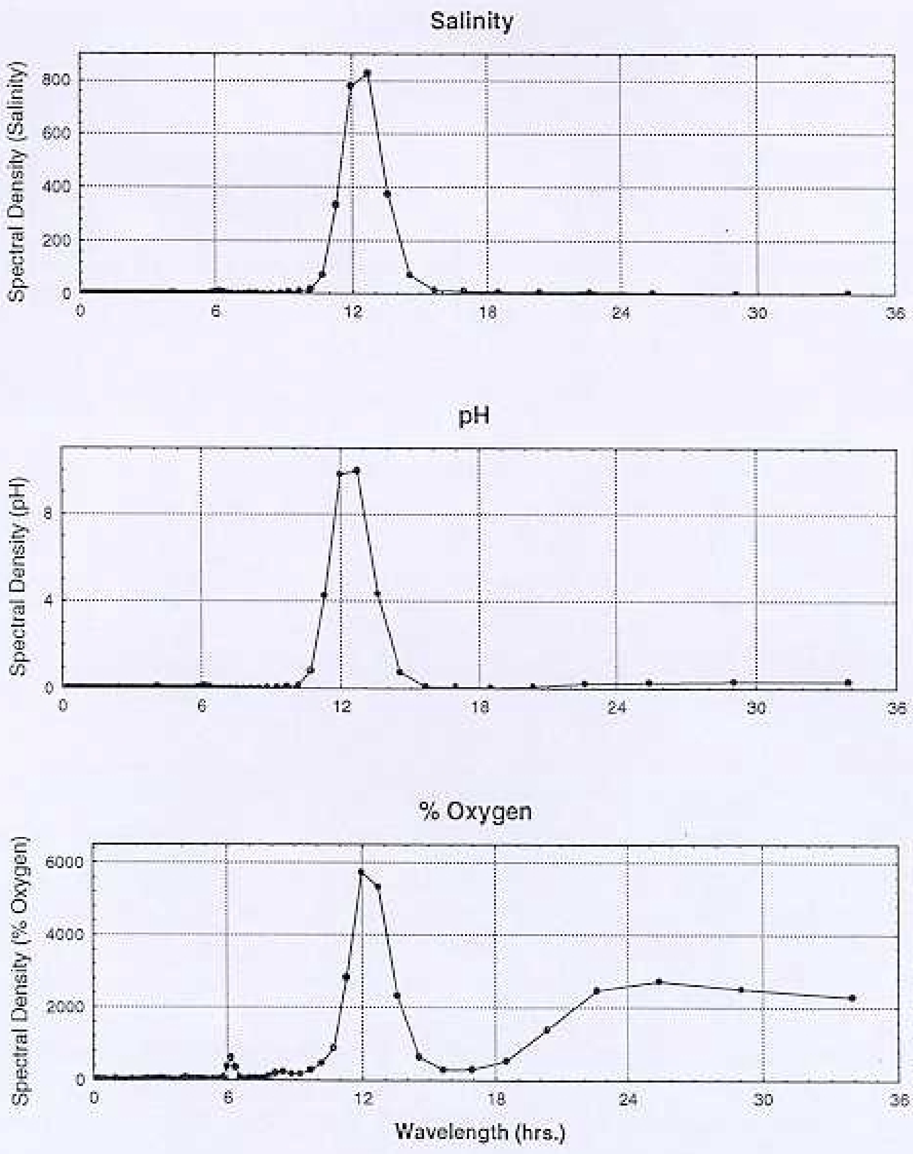


Figure 15.